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**SCREENING AND LOT ACCEPTANCE TESTING OF NONSTANDARD ELECTRONIC PARTS,
GENERAL SPECIFICATION FOR**

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TABLE OF CONTENTS

1. SCOPE	1
2. APPLICABLE DOCUMENTS.....	1
3. REQUIREMENTS.....	5
3.1 General.....	5
3.1.1 Conflicting requirements.....	5
3.1.2 Terms, definitions, and symbols.....	5
3.1.2.1 Delta limit.....	5
3.1.2.2 Control unit.....	5
3.1.2.3 Trace number.....	5
3.1.2.4 Lot number.....	5
3.1.2.5 Contract technical manager.....	6
3.1.2.6 Technical direction.....	6
3.1.3 Mission Class	6
3.2 Lot and part identification and traceability.....	6
3.2.1 Part number.....	6
3.2.2 Part marking.....	6
3.2.2.1 Serialization (for Mission Class A and B applications).....	6
3.2.3 Lot numbers.....	6
3.2.4 Traceability.....	6
3.3 Product assurance requirements.....	6
3.4 Exceptions to general specifications.....	6
3.5 JPL review of screening contractor's documentation.....	7
3.6 Problem notification.....	7
3.7 Status reporting.....	8
3.8 DPA (Destructive Physical Analysis).....	8
4. QUALITY ASSURANCE PROVISIONS.....	8
4.1 Electrical test equipment verification.....	8
4.2 Failure analysis.....	8
4.3 Test method deviation.....	8
4.4 Burn-in test duration.....	8
4.5 Handling.....	8
4.5.1 ESD protection.....	8
4.5.2 Corrosion protection.....	8
4.6 Electrical measurements.....	9
4.6.1 Recording of electrical measurements.....	9
4.6.2 Resolution.....	9
4.7 Lot quality conformance inspection.....	9
4.7.1 Shipments of screened parts.....	9
4.7.2 Hermeticity test of life test parts.....	9
4.8 Test data.....	9
4.8.1 Test report.....	9
4.8.1.1 Electrical test data format.....	10
4.8.1.2 Data retention.....	10
5. PREPARATION FOR DELIVERY.....	10

5.1	Packaging of parts.....	10
5.1.1	ESD protection.....	10
5.2	Marking on initial container (unit package).....	10
5.3	Packing slip and invoice.....	10
6.	NOTES	11
6.1	Ordering data.....	11
6.2	Intended use.....	11
APPENDIX A	- SCREENING REQUIREMENTS.....	A-1
APPENDIX B	- QUALITY CONFORMANCE INSPECTION REQUIREMENTS.....	B-1
APPENDIX C	- UPGRADE SCREENING AND QUALITY CONFORMANCE INSPECTION FOR JANTXV SEMICONDUCTORS	C-1
APPENDIX D	- UPGRADE SCREENING AND QUALITY CONFORMANCE INSPECTION FOR CLASS B MIL-M-38510 MICROCIRCUITS	D-1
APPENDIX E	- BURN-IN TIME-TEMPERATURE REGRESSION REQUIREMENTS.....	E-1
APPENDIX F	- IN-PROCESS INSPECTION REQUIREMENTS.....	F-1

1. SCOPE

This document outlines the minimum test requirements for electronic parts which cannot be procured as MIL qualified (QPL) parts of the necessary grade to meet the quality and reliability requirements as defined by the project mission class. It subsumes (and replaces) ZPP-2074-, 2075-, and 2076-GEN. Sections 1 through 6 are intended for use in acceptance testing of parts which already have been delivered by the manufacturer but have not been tested to meet the mission class requirements for which they are intended. The screening requirements for specific electronic part families are given in Appendix A. The QCI requirements are in Appendix B. Appendix C outlines the recommendations for in-process testing during the manufacturing of electronic parts, where possible. Appendix D outlines procedures for the burn-in of microcircuits and hybrids with maximum operating temperatures lower than 125° C. Appendix E outlines the upgrade screening requirements for JANTXV semiconductors and Appendix F outlines the upgrade screening requirements for Class B microcircuits used in Mission Class A/B applications. These requirements, except Appendix C, apply to both manufacturer and post-receipt acceptance testing: they outline what is required to make a part suitable for use in each JPL mission class. Detail requirements, specific part characteristics, and other provisions which are sensitive to the particular use intended will be specified in the applicable detail specification (usually a JPL ST drawing or a MIL slash sheet). Two levels of quality and reliability, suitable for JPL Mission Class A/B and Mission Class C applications, are provided for.

2. APPLICABLE DOCUMENTS

The requirements of the following documents, of the issue in effect at the time of request for proposal, form a part of this specification to the extent specified herein. (The intent is that the screening and quality conformance inspection (QCI) requirements of the military specifications shall form the baseline; this document lists exceptions to them and indicates which military specification quality levels are appropriate to the respective JPL Mission Classes.)

SPECIFICATIONS

Military

MIL-C-20	Capacitor, Fixed, Ceramic Dielectric (Temperature Compensating), Established Reliability And Non-Established Reliability, General Specification For
MIL-T-27	Transformers and Inductors (Audio, Power, and High Power Pulse) General Specification For
MIL-C-123	Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification For

MIL-R-6106	Relays, Electromagnetic (Includes Established Reliability (ER) Types), General Specification For
MIL-C-14409	Capacitors, Variable (Piston Type, Tubular Trimmer), General Specification For
MIL-S-19500	Semiconductor Devices, General Specification For
MIL-C-19978	Capacitors, Fixed, Plastic (or Paper-Plastic) Dielectric (Hermetically Sealed in Metal, Ceramic, or Glass Cases), Established and Non-Established Reliability, General Specification For
MIL-C-23269	Capacitors, Fixed, Glass Dielectric, Established Reliability
MIL-S-24236	Switches, Thermostatic, (Metallic and Bimetallic), General Specification For
MIL-F-28861	Filters and Capacitors, Radio Frequency/Electromagnetic Interference Suppression, General Specification For
MIL-M-38510	Microcircuits, General Specification For
MIL-H-38534	Hybrid Microcircuits, General Specification For
MIL-I-38535	Integrated Circuits (Microcircuits) Manufacturing, General Specification For
MIL-C-39001	Capacitors, Fixed, Mica Dielectric, Established Reliability, General Specification For
MIL-C-39003	Capacitors, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification For
MIL-C-39006	Capacitors, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, General Specification For

MIL-C-39010	Coils, Fixed, Radio Frequency, Molded, Established Reliability General Specification For
MIL-R-39016	Relays, Electromagnetic, Established Reliability, General Specification For
MIL-C-49467	Capacitors, Fixed, Ceramic, Multilayer, High Voltage (General Purpose) Established Reliability, General Specification For
MIL-R-55342	Resistors, Fixed, Film Chip, Established Reliability, General Specification For
MIL-C-55365	Capacitor, Fixed, Electrolytic (Tantalum), Chip, Established Reliability, General Specification For
MIL-C-55681	Capacitors, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification For
MIL-R-83401	Resistor Networks, Fixed Film and Capacitor-Resistor Networks, Ceramic Capacitors and Fixed Film Resistors, General Specification For
MIL-C-83421	Capacitors, Fixed, Supermetallized Plastic Film Dielectric (DC, AC, or DC and AC) Hermetically Sealed in Metal Cases, Established Reliability, General Specification For
MIL-C-87217	Capacitors, Fixed, Supermetallized Plastic Film Dielectric, Direct Current for Low Energy, High Impedance Applications, Hermetically Sealed in Metal Cases, High Reliability, General Specification For
<u>JPL</u>	
ZPP-2078-GEN	Destructive Physical Analysis of Electronic Parts, General Specification For

CS506099	Thermal Sensors, Platinum Resistance Type, General Specification For
CS510818	Chip Resistor, Fixed Film, General Specification For
CS515579	Relays, Electromagnetic, Low Level to 10 Ampere, General Specification For
CS515580	Hybrid Microcircuits, General Specification For
CS515903	Relays, Electromagnetic, 5 Amperes and Upward, General Specification For

STANDARDS

Military

MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-750	Test Methods for Semiconductor Devices
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-981	Design, Manufacturing, and Quality Standards for Custom Electromagnetic Devices for Space Application
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

OTHERS

GSFC

S-311-P-18	Goddard Space Flight Center; Thermistor (Thermally Sensitive Resistor) Insulated, Negative Temperature Coefficient Style 311P18, Specification For
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3. REQUIREMENTS

3.1 General.

3.1.1 Conflicting requirements. In the event of conflict between the requirements of this specification and other requirements, the precedence in which requirements shall govern, in descending order, is as follows:

- a. procurement document (contract or purchase order)
- b. screening and QCI requirements of the applicable part specification (associated detail specification or drawing.)
For screening contractors, detail specification requirements for manufacturing activities such as marking, packaging, and radiation testing do not apply.
- c. this specification
- d. specifications and standards referenced in 2.1

3.1.2 Terms, definitions, and symbols. The following terms and definitions shall apply:

3.1.2.1 Delta limit. The maximum change in a specified parameter reading which will permit a part to be accepted on the specified test, based on a comparison of a post test measurement with that recorded prior to the initiation of the same test, unless otherwise noted in the test requirements.

3.1.2.2 Control unit. A control unit is a part of the same part type, package, and manufacturer (but not necessarily of the same lot) as the test specimens, but which is not subjected to any of the stresses that are applied to the test specimens. It is used to verify the repeatability of measurements. Secondary standards may be used in the case of passive parts.

3.1.2.3 Trace number. The trace number is the number assigned by the procurement document to link a part number to the specific purchase order or order release under which it originally was procured. The trace number for a given part or set of parts will not change.

3.1.2.4 Lot number. The lot number shall identify a group of parts which are tested together and which are of the same part type, manufacturer, date code, and (if applicable) manufacturer's inspection lot number. Where QCI is required, the suffix "Q" may be added to the lot number to distinguish it from the screening lot number.

3.1.2.5 Contract technical manager. The contract technical manager shall be the principal technical interface between the screening agency and JPL.

3.1.2.6 Technical direction. Technical direction shall mean written direction, usually on a JPL Technical Direction Memorandum (TDM) form.

3.1.3 Mission Class. The requirements herein for JPL Mission Class A/B shall apply unless stated otherwise in the detail specification or procurement document.

3.2 Lot and part identification and traceability.

3.2.1 Part number. The suffix "JU" shall be used with the as-procured part number to indicate acceptance testing in accordance with the Mission Class A/B requirements of this specification. This suffix need not be marked on the parts.

3.2.2 Part marking. The marking on the parts when they are delivered to the screening contractor shall not be removed or changed except for the addition of serial numbers, where applicable.

3.2.2.1 Serialization (for Mission Class A and B applications). Parts shall be serialized prior to the first required inspection point. Care shall be taken not to cover other part markings with the serial numbers. Serial numbers marked on the parts when they are delivered to the screening agency shall be unchanged. The preferred method of serialization is with permanent ink. As an alternative, parts may be marked with adhesive labels (Avery-Heatex or W.H. Brady B953 HT2000). Labels affixed to leads shall be ≥ 0.5 inches from the body of the part. Parts too small to be labeled shall be packaged so as to maintain the serial number identity of each part.

3.2.3 Lot numbers. Test lot numbers shall be assigned in accordance with paragraph 3.1.2.4. Parts of the same basic type but with multiple values shall be divided into screening subgroups by parametric values.

3.2.4 Traceability. Traceability existing when parts are delivered for test shall be maintained. If serialization is required, traceability shall extend from each serialized part.

3.3 Product assurance requirements. The screening contractor shall have a quality assurance program that meets the portions of MIL-M-38510 Appendix A requirements which pertain to testing parts.

3.4 Exceptions to general specifications. The following exceptions apply to screening of parts by an agency other than the manufacturer:

- a. Incoming inspection. The screening contractor shall perform external visual and dimensional inspection, in accordance with the applicable specifications, prior to the first inspection point required in Appendix A.
- b. In-process inspections. Internal visual inspections and other in-process inspections do not apply.

3.5 JPL review of screening contractor's documentation. The screening contractor shall make available the following items for review and acceptance by the JPL contract technical manager prior to use with their respective JPL lots:

- a. Lot traveler(s) for each part type (covering screen and QCI operations). Travelers shall include as a minimum the following:
 - (1) Part number, date code (if applicable), and lot number

- (2) Name or title of operation and specification number of associated process or test
 - (3) Date(s) of operation and operator identification
 - (4) Calibration control number or equipment identification of all major equipment components used for test
 - (5) Quantity tested and rejected for each operation or test (and actual quantity tested if a sample)
 - (6) Serial numbers of failed parts (if applicable)
 - (7) Time in and out of process or test if critical to process or test results (e.g., burn-in window)
 - (8) Specific major conditions of test that are verifiable by operator, including times, temperatures, etc.
 - (9) Percent defective calculations
 - (10) Burn-in and life test board serial number or test circuit identification number and revision
 - (11) Requirements for variables data
 - (12) Electrical test program numbers and revisions
- b. Electrical test program and data recorded from a control unit of the specified type taken over the full specified temperature range
 - c. Bench test procedures, if applicable

3.6 Problem notification. The contractor shall notify the JPL contract technical manager and the contract negotiator within one working day of the occurrence of any of the following:

- a. Any group of parts received under the same trace number which is comprised of more than one date code
- b. Any DPA failure
- c. Any catastrophic failure after initial electrical test
- d. Any failures in excess of PDA, including failures which appear to result from equipment failure or operator error
- e. Any life test failure
- f. Any need for re-marking serial numbers

3.7 Status reporting. The contractor shall provide the JPL contract technical manager and the contract negotiator every two weeks with an oral or written status report stating the current status (point on the lot traveler and quantity of parts in the lot) and expected ship date of each lot in process, and noting any significant problems.

3.8 DPA (Destructive Physical Analysis). When required by the procurement document, DPA shall be performed in accordance with JPL specification ZPP-2078-GEN prior to the start of screening.

4. QUALITY ASSURANCE PROVISIONS

4.1 Electrical test equipment verification. Two control units shall be measured and recorded immediately before and after each set of electrical measurements of the test specimens. (It is preferred that the same control units be used for all JPL lots of the same device type.) Each set of control unit measurements shall be checked for consistency with the last prior set of control unit measurements before proceeding with testing of the lot. In the event of significant discrepancy between two sets of readings, corrective action (maintenance, recording of open-socket measurements, or re-calibration of the test equipment) and retest of control units shall be accomplished before proceeding with testing of the lot. Note that these control units shall be used for measurements during QCI tests as well as during screening.

4.2 Failure analysis. The manufacturer or test facility shall not perform any analysis destructive to the part without prior technical direction from the JPL contract technical manager.

4.3 Test method deviation. Deviations from JPL-approved test methods must be approved by technical direction from the JPL contract technical manager before testing is begun.

4.4 Burn-in test duration. Microcircuits and hybrids with maximum rated operating temperatures other than 125°C shall have burn-in test durations changed in accordance with Appendix E.

4.5 Handling.

4.5.1 ESD protection. Devices which have not been tested or rated for ESDS classification shall be considered to be Class 1 as defined in MIL-STD-1686.

4.5.2 Corrosion protection. Solvents and/or water shall not be used on the parts without approval by technical direction from the JPL contract technical manager. The following shall be avoided:

- a. corrosive contaminants in test chambers
- b. handling of parts by the leads
- c. corrosive packing materials

4.6 Electrical measurements.

4.6.1 Recording of electrical measurements. All specified electrical measurements shall be recorded for Mission Class A and B lots.

4.6.2 Resolution. Resolution of electrical test data shall be equal to or better than 10% of the delta limit on that parameter. If no delta limit exists, the resolution shall be equal to or better than 1.0% of the original parameter.

4.7 Lot quality conformance inspection.

4.7.1 Shipments of screened parts. Screened parts shall not be shipped in advance of completion of any required QCI unless the JPL contract technical manager has given technical direction to do so or unless prior shipment is required herein (e.g., catastrophic failures).

4.7.2 Hermeticity test of life test parts. Life test samples of hermetically sealed parts shall be tested for fine and gross leak after completion of the post-life test electrical measurements.

4.8 Test data.

4.8.1 Test report. A test report containing the following data shall be included with each shipment of screened parts:

- a. cover sheet identifying the part number (including value and tolerance if applicable) and nomenclature, part manufacturer, test lot number, date code (if available), JPL trace number, test agency, screening contract number, quantity of parts in the lot, and date of the report
- b. table of contents
- c. copy of the completed lot traveler(s) used for screening and QCI
- d. attributes test data, including the X-ray report and films where applicable
- e. electrical test data for all specified tests, including control unit data and delta calculations
- f. summary of parts fallout
- g. data for any other special tests required by the detail specification or procurement document
- h. copies of any engineering evaluations performed by the manufacturer
- i. copies of any waivers or Technical Direction Memoranda (TDMs) altering the specified requirements
- j. a copy of the detail specification

4.8.1.1 Electrical test data format. If tests are labeled with test numbers, a cross-reference shall be provided to relate test numbers to descriptive test name (e.g, IIL, VOH) and pin number. It is preferred that printed electrical test data be formatted such that all measurements of a given parameter are displayed in a column, in serial number order. Electrical test data also shall be provided in a magnetic medium: either IBM DOS-compatible 5-1/4" or 3-1/2" diskette with data in ASCII format or 9-track tape (800 or 1600 bpi) with data in ASCII or EBCDIC format.

4.8.1.2 Data retention. The contractor shall retain a copy of the test data for a minimum of 3 years.

5. PREPARATION FOR DELIVERY

5.1 Packaging of parts. Parts shall be packaged for delivery in serial number order in clear plastic containers. Control units and rejects shall be packaged separately and marked accordingly.

5.1.1 ESD protection. All parts shall be packaged in accordance with the requirements for Class 1 ESDS parts per the requirements of MIL-STD-1686.

5.2 Marking on initial container (unit package). The container shall be marked with:

- a. the part number
- b. the manufacturer's name
- c. the test lot number
- d. the date code (if available)
- e. the number of the detail specification (JPL specification or military slash sheet)
- f. the JPL trace number
- g. the number of parts contained
- h. the serial number range (if applicable)
- i. ESD caution label.

5.3 Packing slip and invoice. The packing slip and invoice shall include the information in listed under 5.2 a-f (above).

6. NOTES

6.1 Ordering data. Procurement documents will specify the following:

- a. Type designation/part number

- b. Number of associated detail specification
- c. Mission Class if it is not A/B
- d. Any difference in test data requirements from those listed in the detail or test specification.
- e. Name and telephone number of JPL contract negotiator
- f. Name and telephone number of JPL contract technical manager
- g. JPL trace number
- h. Any special requirements which differ from those indicated herein or in the detail specification (e.g., those involving ESD sensitivity, traceability, DPA, radiation test, etc.).

6.2 Intended use. Electronic parts tested in conformance with Sections 1 through 5 of this specification are intended for use when manufacturer-screened parts of adequate performance and radiation hardness are not readily available at an acceptable cost. The summary requirements of Appendix A apply to all flight parts of the respective families, without regard to which agency performs the screening and QCI. The complete requirements for procurement of manufacturer-screened flight parts are given in the appropriate JPL "CS" specification for each part family.

APPENDIX A - SCREENING REQUIREMENTS

10. SCOPE

This appendix contains the recommended 100% screening tests required for various types of non-standard electronic parts as defined in JPL D-5357 or project parts requirements documents. Where possible, the military specification requirements are referenced. This appendix is not intended to be used in lieu of screening test procedures and requirements, but rather, for their development. Specific parts may require additional tests to those prescribed in this appendix. The details of the screening specifications for nonstandard/non-MIL parts must take into account the type of part; its function, design, construction, and manufacturing; its significant failure modes and sensitivities; and the track record of its manufacturer. The user must make certain that the specified tests are non-destructive, that the appropriate test parameters and limits are included, and that a lot Percent Defective Allowable (PDA) is imposed where appropriate. For Mission Class A/B devices, all data is read and record by serial number. For all Mission Class devices, radiation tolerances shall be met per project requirements.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. SCREENING TESTS

30.1 ASICs. ASICs screening shall be per MIL-I-38535, Class V, (Appendix B) requirements for Mission Class A/B and Class Q requirements for Mission Class C.

30.2 Capacitors. The tables below describe the screening requirements for capacitors used in both Mission Class A/B applications and Mission Class C applications. For Mission Class A/B applications, the devices shall be serialized prior to the initiation of testing per paragraph 3.2.2.1 herein. The order of and the procedures for the tests shall be per the Military specification referenced in the bottom row of the tables.

	Air/glass variable	Ceramic: gen. purpose	Ceramic: temp. compensated	Ceramic: chip
Initial/final visual & electrical	visual, DWV, capacitance, Q factor, IR, driving torque	visual, DWV, capacitance, Q factor, IR	visual, DWV, capacitance, Q factor, IR	visual, DWV, capacitance, Q factor, IR
Thermal shock	5 cycles, -55°C to +125°C	5 cycles, -55°C to +125°C	5 cycles, -55°C to +125°C	5 cycles, -55°C to +125°C
Voltage conditioning (Burn-in)	168 hrs min, 1.5x rated voltage @ +125°C	168 hrs min, 2x rated voltage @ max. temp	168 hrs min, 2x rated voltage @ +125°C	168 hrs min, 2x rated voltage @ max.temp
Radiographic insp.	----	per MIL-spec	----	----
Other	----	----	----	----
Reference MIL-spec.	MIL-C-14409	MIL-C-123	MIL-C-20	MIL-C-55681

CAPACITOR - SCREENING TEST REQUIREMENTS (cont'd)

	High voltage	Glass	Mica	Paper &/or Plastic film
Initial/final visual & electrical	visual, DWV, IR, capacitance, dissipation factor	visual, DWV, capacitance, dissipation factor, IR	visual, DWV, capacitance, Q factor, IR	visual, DWV, capacitance, IR, dissipation factor
Thermal shock	5 cycles, -55°C to +125°C	5 cycles, -55°C to +125°C	5 cycles, -55°C to +125°C	test condition B 5 cycles @ -65°C to max. ambient
Voltage conditioning (Burn-in)	168 hrs min, 1x rated voltage @ +125°C	168 hrs min, 1x rated voltage @ max. temp	168 hrs min, 2x rated voltage @ +125°C	168 hrs min, 1.4x rated dc voltage @ max. temp
Radiographic inspection	----	----	----	per MIL-spec
Other	Partial discharge	Seal	----	Seal
Reference MIL-specification	MIL-C-49467	MIL-C-23269	MIL-C-39001	MIL-C-19978

CAPACITOR - SCREENING TEST REQUIREMENTS (cont'd)

	Polycarbonate metal film	Tantalum: wet slug & foil	Solid tantalum	Chip tantalum
Initial/final visual & electrical	visual, DWV, capacitance, IR, dissipation factor, equiv. series resistance	visual, dc leakage, capacitance, dissipation factor	visual, dc leakage, capacitance, dissipation factor, equiv. series resistance	visual, dc leakage, capacitance, dissipation factor, equiv. series resistance
Thermal shock	test condition B, 5 cycles	5 cycles, -55°C to +125°C	test condition B, 5 cycles, -65°C to +125°C	5 cycles, -55°C to +125°C
Voltage conditioning (Burn-in)	168 hrs. min., 1.4x rated dc voltage @ max. temp	168 hrs. min., 1x rated voltage @ +85°C	168 hrs. min., 1x rated dc voltage @ +85°C	168 hrs. min., 1x rated dc voltage @ +85°C
Radiographic inspection	----	----	per MIL-spec	----
Other	Seal	Seal	Surge current, Seal	----
Reference MIL-specification	MIL-C-83421 1/	MIL-C-39006	MIL-C-39003	MIL-C-55365

Notes: 1/ When parts are used in direct current for low energy and high impedance applications, they must also be tested to the requirements of MIL-C-87217.

30.3 Crystals. The screening requirements for crystals are as shown below.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Aging	85°C for 30 days	85°C for 30 days
Visual/dimensional	per detail specification	per detail specification
Electrical measurements	Read and Record 1/	Read only 1/
Thermal shock	MIL-STD-202, method 107, condition B	MIL-STD-202, method 107, condition B
Particle Impact Noise Detection (PIND)	MIL-STD-883, method 2020, condition A	MIL-STD-883, method 2020, condition A
Vibration	MIL-STD-202, method 204, condition A	MIL-STD-202, method 204, condition A
Seal test	MIL-STD-202, method 112, condition C	MIL-STD-202, method 112, condition C
Radiographic inspection	MIL-STD-202, method 209	MIL-STD-202, method 209
Electrical measurements	Read and Record 1/	Read only 1/
Visual inspection	per detail specification	per detail specification

Notes: 1/ Parametric measurements shall include frequency, equivalent resistance, and shunt capacitance as applicable per detail specification.

30.4 Discrete Semiconductors. Semiconductors shall be screened to the requirements of MIL-S-19500, TABLE II except delete step 6 (FIST and BIST) and step 3 surge and thermal response tests. Electronic devices intended for Mission Class A/B use shall be screened to JANS requirements, while devices intended for Mission Class C use shall be screened to JANTXV requirements. To upgrade screen MIL-S-19500 qualified JANTXV devices for use in Mission Class A/B applications, refer to Appendix C.

30.5 Filters. Filters shall be screened per MIL-F-28861. For Mission Class A/B applications, filters shall be subjected to the tests specified for Class S devices. For Mission Class C applications, filters shall be subjected to the tests specified for Class B devices.

30.6 Fuses. The screening requirements for fuses are as shown below.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Visual examination <u>1/</u>	25x magnification minimum	25x magnification minimum
Electrical measurements (initial)	per detail specification	per detail specification
Operational run-in	24 hours @ max. temperature @ 50% rated current	24 hours @ max. temperature @ 50% rated current
Current stress	@100% rated current @25°C for 15 ± 1 seconds	@100% rated current @25°C for 15 ± 1 seconds
Electrical measurements <u>2/</u>	per detail specification	per detail specification
Thermal shock	per MIL-STD-202, method 107, condition A	per MIL-STD-202, method 107, condition A
Electrical measurements <u>2/</u>	per detail specification	per detail specification
Gross leak test (liquid immersion) <u>3/</u>	15 second immersion minimum	15 second immersion minimum
Visual examination <u>1/</u>	25x magnification minimum	25x magnification minimum

Notes: 1/ Visual inspection: Inspect for damage and workmanship defects.

a) Wire leads: shall be attached firmly with no visible signs of solder voids, cracking or breaking. The lead plating shall be uniform in appearance and free of oxidation and corrosion. There shall be no bends, twists, or kinks in the external leads.

b) Ceramic or glass envelope: shall be free of rupture cracks. There shall be no evidence of loose metallic particles or extraneous materials within the envelope.

c) Fuse element (glass envelope parts only): shall be free of any adhering particles or foreign materials such as sealant, flux solder, paint, corrosion, or signs of overheating. There shall be evidence of solder between the fuse element and external lead wire when viewed through the glass envelope.

2/ Maximum deviation between measurement and initial measurement shall be ± 10%.

3/ Immersion for 15 seconds minimum in fluorocarbon FC-40, FC-43 or FC-48 at approximately 85°C. Devices that bubble shall be rejected.

30.7 Hybrids. Hybrid screening shall be per MIL-H-38534, Class K, option 2 requirements for Mission Class A/B and Class H requirements for Mission Class C.

30.8 Inductors/Coils. The screening requirements for inductors and coils are as shown below.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Electrical measurements	per detail specification	per detail specification
Insulation resistance	per MIL-STD-981	per MIL-STD-981
Dielectric withstanding voltage	per MIL-STD-981	per MIL-STD-981
Thermal shock	per MIL-STD-202, method 107 1/	per MIL-STD-202, method 107 1/
Electrical measurements	per detail specification	per detail specification
Burn-in	per MIL-STD-981, except 240 hours	per MIL-STD-981, except 168 hours
Electrical measurements	per detail specification	per detail specification
Dielectric withstanding voltage	per MIL-STD-981	per MIL-STD-981
Q factor	per MIL-STD-981	per MIL-STD-981
Self resonant frequency	per MIL-STD-981	per MIL-STD-981
Insulation resistance	per MIL-STD-981	per MIL-STD-981
Radiographic inspection	per MIL-STD-981	----
Visual and dimensional examination (external)	per MIL-STD-981	per MIL-STD-981

Notes: 1/ Condition A, except for 10 thermal cycles and to the maximum and minimum operating temperature of the device per the detail specification.

30.9 Microcircuits. Microcircuits shall be screened to the requirements of MIL-STD-883, method 5004. Electronic devices intended for Mission Class A/B use shall be screened to the Class S requirements, while devices intended for Mission Class C use shall be screened to the Class B requirements. To upgrade screen MIL-M-38510 qualified Class B devices for use in Mission Class A/B applications, refer to Appendix D.

30.10 Relays. Relays shall be screened per the requirements of JPL specification CS515579 for relays with current rating $0 \leq I < 5A$, or CS515903 for relays with current rating $I \geq 5A$.

30.11 Resistive Heaters. The screening requirements for resistive heaters are shown below.

TEST 1/	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Visual and mechanical	per detail specification	per detail specification
Heater resistance	MIL-STD-202, method 303	MIL-STD-202, method 303
Burn-in	168 hours, max operating temperature, rated power	168 hours, max operating temperature, rated power
Over voltage	per detail specification	per detail specification
Heater resistance	MIL-STD-202, method 303	MIL-STD-202, method 303
Thermal shock	MIL-STD-202, method 107 condition C	MIL-STD-202, method 107 condition C
Heater Resistance	MIL-STD-202, method 303	MIL-STD-202, method 303
Insulation Resistance	MIL-STD-202, method 302 condition B	MIL-STD-202, method 302 condition B
Dielectric strength	MIL-STD-202, method 301	MIL-STD-202, method 301
Insulation resistance	MIL-STD-202, method 302 condition B	MIL-STD-202, method 302 condition B
Heater resistance	MIL-STD-202, method 303	MIL-STD-202, method 303

Notes: 1/ Parameters per detail specification with delta criteria where applicable.

30.12 Resistors. The screening requirements for resistors, except resistive heaters, chip resistors, and resistor networks, are shown below. Chip resistors shall be manufactured and tested to MIL-R-55342 for use in Mission Class A/B applications. For chip resistors which are not manufactured and tested to MIL-R-55342, no screening shall be performed but quality conformance inspection requirements shall be imposed per Appendix B.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Visual inspection	per detail specification	per detail specification
Electrical measurements	as specified (read and record) 1/	as specified (read only) 1/
Thermal shock	MIL-STD-202, method 107	MIL-STD-202, method 107
Electrical measurements	as specified (read and record) 1/	as specified (read only) 1/
Burn-in	per detail specification	per detail specification
Seal test 2/	MIL-STD-883, method 1014	---
Electrical measurements	as specified (read and record) 1/	as specified (read only) 1/
Visual inspection	per detail specification	per detail specification

Notes: 1/ Parameters per detail specification with delta criteria where applicable.
 2/ Applies to hermetically sealed devices only.

30.13 Resistor Networks. The screening requirements for resistor networks are shown below. All tests are to be performed in accordance with the requirements of MIL-R-83401.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Electrical measurements	per detail specification	per detail specification
Thermal shock	per MIL-R-83401	per MIL-R-83401
Power conditioning	per MIL-R-83401, 168 hours	per MIL-R-83401, 168 hours
Radiographic inspection	per MIL-R-83401	per MIL-R-83401
Hermetic seal (when applicable)	per MIL-R-83401	per MIL-R-83401
Electrical measurements	per detail specification	per detail specification
Visual examination	per MIL-R-83401	per MIL-R-83401

30.14 Switches. The screening requirements for switches are as shown below.

TEST	MISSION CLASS A AND B	MISSION CLASS C
Serialization	per 3.2.2.1 herein	----
Visual examination	per detail specification	per detail specification
Vibration test	per MIL-S-24236	per MIL-S-24236
Shock	per MIL-S-24236	per MIL-S-24236
Seal test	per MIL-S-24236	per MIL-S-24236
Dielectric withstanding voltage	per MIL-S-24236	per MIL-S-24236
Insulation resistance	per MIL-S-24236	per MIL-S-24236
Contact resistance	per MIL-S-24236	per MIL-S-24236
Visual examination	per detail specification	per detail specification

30.15 Thermal Sensors. Thermal sensors shall be screened to the requirements of JPL document CS506099. Devices intended for Mission Class A/B or Mission Class C shall be screened to the same requirements.

30.16 Thermistors. Thermistors shall be screened to the requirements of Goddard Space Flight Center document GSFC S-311-P-18. Devices intended for Mission Class A/B or Mission Class C shall be screened to the same requirements.

30.17 Transformers. The screening requirements for transformers are as shown below.

TEST	MISSION CLASS	
	A/B	C
Serialization	per 3.2.2.1 herein	----
Electrical measurements	per detail specification	per detail specification
Insulation resistance	per MIL-STD-981	per MIL-STD-981
Dielectric withstanding voltage	per MIL-STD-981	per MIL-STD-981
Thermal shock	per MIL-STD-202, method 107 <u>1</u> /	per MIL-STD-202, method 107 <u>1</u> /
Electrical measurements	per detail specification	per detail specification
Burn-in	per MIL-STD-981, except 240 hours	per MIL-STD-981, except 168 hours
Electrical measurements	per detail specification	per detail specification
Dielectric withstanding voltage	per MIL-STD-981	per MIL-STD-981
Induced voltage	per MIL-STD-981	per MIL-STD-981
Insulation resistance	per MIL-STD-981	per MIL-STD-981
Seal test (when applicable) <u>2</u> /	per MIL-STD-981	per MIL-STD-981
Radiographic inspection	per MIL-STD-981	----
Visual and dimensional examination (external)	per MIL-STD-981	per MIL-STD-981

Notes: 1/ Condition A, except for 10 thermal cycles and to the maximum and minimum operating temperature of the device per the detail specification.

2/ Applies to hermetically sealed devices only.

APPENDIX B - QUALITY CONFORMANCE INSPECTION REQUIREMENTS

10 . SCOPE

This appendix contains the required post-assembly lot quality conformance inspection (QCI) tests required for various types of electronic parts. Where possible, the military specification requirements are referenced. This appendix is not intended to be used in lieu of test procedures and requirements, but rather, for their development. Specific devices may require additional tests to those prescribed in this appendix. The details of the QCI specifications for nonstandard/non-MIL parts must take into account the type of part; its function, design, construction, and manufacturing; and its significant failure modes and sensitivities. The user must make certain that the appropriate test parameters and limits are included in the QCI specification.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. QUALITY CONFORMANCE INSPECTION (QCI) TESTS

30.1 ASICs. ASICs lot quality conformance inspection requirements shall be per MIL-I-38535, Class V, (Appendix B) requirements for Mission Class A/B.

Note: Destructive physical analysis (DPA) is required per ZPP-2078-GEN for both Mission Class A/B and Mission Class C applications.

30.2 Capacitors. Lot quality conformance inspection is not required for leaded capacitors. For chip capacitors not manufactured and tested to MIL-C-123 or 100% burned-in during screening, extended QCI is required. Consult JPL capacitor reliability specialist for recommended tests and sample quantities. Solderability testing per MIL-C-55681, Group B, including sample size and failures allowed, will be required as part of the extended QCI.

Note: Destructive physical analysis (DPA) is required on ceramic capacitors per ZPP-2078-GEN for both Mission Class A/B and Mission Class C applications. DPA is not required on MIL-C-123 QPL ceramic capacitors.

30.3 Crystals. The lot quality conformance inspection requirements for crystals are as shown below.

TEST	SAMPLE SIZE	MIL-STD-202, METHOD	CONDITIONS
<i>Subgroup 1</i>	1Ø/Ø		
Vibration		2Ø4	condition A
Thermal shock		1Ø7	condition B-3
Lead integrity		211	condition A, 2 lbs for flexible leads, 4 lbs for rigid leads
Electrical measurements			per detail specification
Seal		112	condition C
<i>Subgroup 2</i>	1Ø/Ø		
Electrical measurements			per detail specification
Life			1ØØØ hours @ max. operating conditions
Electrical measurements			per detail specification
Seal		112	condition C

30.4 Discrete Semiconductors. The lot quality conformance inspection for semiconductors shall meet the requirements of MIL-S-195ØØ for the tests specified.

For Mission Class A/B the requirement is:

Life test: 1ØØØ hours, using the same burn-in conditions and electrical measurements as those required by the applicable detail specification for power burn-in during screening.

Note: Destructive physical analysis (DPA) is required per ZPP-2Ø78-GEN for both Mission Class A/B and Mission Class C applications.

30.5 Filters. The lot quality conformance inspection for filters shall be per MIL-F-28861. For Mission Class A/B applications, filters shall be subjected to the tests specified for Class S devices. For Mission Class C applications, filters shall be subjected to the tests specified for Class B devices.

Note: Destructive physical analysis (DPA) is required per ZPP-2Ø78-GEN for both Mission Class A/B and Mission Class C applications.

30.6 Fuses. The QCI requirements for fuses are as shown below.

TEST	SAMPLE SIZE/ ACCEPT #	MIL-STD-202 METHOD	CONDITIONS
<i>Subgroup 1 /</i>	45/0		
Electrical measurements			per detail specification
Steady-state life			1000 hours @ 75% rated current and T _A = +25°C
Electrical measurements			per detail specification
<i>Subgroup 2</i>	10/0		
Thermal shock		107	Condition A
Electrical measurements			per detail specification
<i>Subgroup 3 1/</i>	<u>2</u> /		
Blowing time			per detail specification
Insulation Resistance		302	Condition A
Terminal strength		211	Condition A, 5 lbs. axial pull

Notes: 1/ Destructive test
 2/ Three devices or 1% of the inspection lot, whichever is
 greater, to the maximum of 5 total devices.

30.7 Hybrids. The lot quality conformance inspection requirements for hybrids shall be per MIL-H-38534, option 2 for Mission Class A/B applications. Lot QCI is not required for Mission Class C applications.

Note: Destructive physical analysis (DPA) is required per ZPP-2078-GEN
 for both Mission Class A/B and Mission Class C applications.

30.8 Inductors/Coils. The lot quality conformance inspection requirements for inductors and coils used in Mission Class A/B applications are as shown below. QCI is not required for inductors and coils used in Mission Class C applications.

Note: Destructive physical analysis (DPA) is required on MIL-C-39010 coils per ZPP-2078-GEN for both Mission Class A/B and Mission Class C applications.

TEST	SAMPLE SIZE	NO. FAILURES ALLOWED	CONDITIONS
<i>Subgroup 1</i>			
Resistance to soldering heat	2	Ø	per MIL-STD-981
Terminal strength			per MIL-STD-981
Temperature rise			per MIL-STD-981
Electrical measurements			per detail specification
Vibration			per MIL-STD-981
Shock			per MIL-STD-981
Electrical measurements			per detail specification
Dielectric withstanding voltage			per MIL-STD-981
Insulation resistance			<u>3</u> /
Visual & mechanical inspection (external)			per MIL-STD-981
<i>Subgroup 2</i>			
Resistance to solvents	2	Ø	per MIL-STD-981
Solderability			per MIL-STD-981
Electrical measurements			per detail specification
Dielectric withstanding voltage			per MIL-STD-981
Extended thermal shock cycles <u>1</u> /			<u>4</u> /
Electrical measurements			per detail specification
Insulation resistance			<u>3</u> /
Dielectric withstanding voltage			per MIL-STD-981
Visual & mechanical inspection (external)			per MIL-STD-981
<i>Subgroup 3</i>			
Corona discharge <u>2</u> /	2	Ø	per MIL-T-27

- Notes:
- 1/ Continually monitor continuity during all thermal shock cycles to verify no intermittent conditions. Continuity monitoring current shall not exceed 3 microamperes. Equipment shall be capable of detecting intermittent opens exceeding 100 microseconds.
 - 2/ Applicable when materials are stressed greater than 100 volts/mil due to maximum operating voltage. One sample from each subgroup shall be chosen for this test.
 - 3/ Test at specified maximum voltage with insulation resistance of 10,000 megohms minimum, per MIL-STD-981.
 - 4/ Per MIL-STD-202, method 107, condition A-1

30.9 Microcircuits. The lot QCI for microcircuits shall meet the requirements for MIL-STD-883, method 5005.

For Mission Class A/B applications the requirements are:

- Group A (unless all Group A tests were performed as part of screening)
- Group B, subgroups 5 & 6 per TABLE IIa Class S requirements
- Group D (generic data from the preceding 6-month period may be used)

Note: Destructive physical analysis (DPA) is required per ZPP-2078-GEN for both Mission Class A/B and Mission Class C applications.

30.10 Relays. The lot quality conformance inspection requirements for relays used in Mission Class A/B applications are per the requirements of JPL specification CS515579 for relays with current rating $0 \leq I < 5A$, or CS515903 or relays with current rating $I \geq 5A$. If the relay manufacturer is QPL listed for any MIL-R-39016 or MIL-R-6106 relay, lot QCI is not required.

Note: Destructive physical analysis (DPA) is required per ZPP-2078-GEN for both Mission Class A/B and Mission Class C applications.

30.11 Resistive Heaters. Lot quality conformance inspection is not required for resistive heaters.

30.12 Resistors. Lot quality conformance inspection is not required for resistors with a military specification established reliability failure rate or where 100% burn-in is performed during screening. Chip resistors that are not manufactured to MIL-R-55342 or are not 100% burned-in during screening must meet all requirements of JPL CS510818.

30.13 Resistor Networks. Lot quality conformance inspection is not required for resistor networks.

30.14 Switches. The lot quality conformance inspection requirements for switches used in Mission Class A/B applications are as shown below. All tests are to be performed in accordance with the requirements of MIL-S-24236. QCI is not required for switches used in Mission Class C applications.

TEST	SAMPLE QUANTITY /FAILURES ALLOWED	CONDITIONS
Thermal shock	4/Ø	Condition B-3
Vibration		Condition D
Seal		
Dielectric withstanding voltage		Maximum rated operating voltage
Contact resistance		

30.15 Thermal Sensors. Lot quality conformance inspection testing is not required for thermal resistors.

30.16 Thermistors. Lot quality conformance inspection testing is not required for thermistors.

30.17 Transformers. The QCI requirements for transformers used in Mission Class A/B applications are as shown below. QCI is not required for transformers used in Mission Class C applications.

TEST	SAMPLE SIZE	NO. FAILURES ALLOWED	CONDITIONS
<i>Subgroup 1</i>			
Resistance to soldering heat	2	Ø	per MIL-STD-981
Terminal strength			per MIL-STD-981
Electrical measurements			per detail specification
Dielectric withstanding voltage			per MIL-STD-981
Extended thermal shock cycles 1/			per MIL-STD-202, method 107, condition A-1
Electrical measurements			per detail specification
Dielectric withstanding voltage			per MIL-STD-981
Insulation resistance			3/
Visual & mechanical inspection (external)			per MIL-STD-981
<i>Subgroup 2</i>			
Electrical measurements	2	Ø	per detail specification
Vibration			per MIL-STD-981
Shock			per MIL-STD-981
Electrical measurements			per detail specification
Resistance to solvents			per MIL-STD-981
Solderability			per MIL-STD-981
Insulation resistance			3/
Dielectric withstanding voltage			per MIL-STD-981
Visual & mechanical inspection (external)			per MIL-STD-981
<i>Subgroup 3</i>			
Corona discharge 2/ (when applicable)	2	Ø	per MIL-T-27

Notes:

1/ Continually monitor continuity during all thermal shock cycles to verify no intermittent conditions. Continuity monitoring current shall not exceed 3 microamperes. Equipment shall be capable of detecting intermittent opens exceeding 100 microseconds.

2/ Applicable when materials are stressed greater than 100 volts/mil due to maximum operating voltage. One sample from each subgroup shall be chosen for this test.

3/ Test at specified maximum voltage with insulation resistance of 10,000 megohms minimum, per MIL-STD-981.

APPENDIX C - UPGRADE SCREENING AND QUALITY CONFORMANCE INSPECTION
FOR JANTXV SEMICONDUCTORS

10. SCOPE

This appendix defines the requirements for upgrade screening test and quality conformance inspection (QCI) requirements of MIL-S-19500 JANTXV semiconductor devices for use in Mission Class A/B applications. These requirements are for semiconductor devices qualified to MIL-S-19500 JANTXV level only. For devices that are not qualified to MIL-S-19500 JANTXV level, refer to Appendices A and B for screening and quality conformance inspection requirements.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. DETAIL REQUIREMENTS

30.1 Screening requirements. The tests of Table I. are to be performed on 100% of the devices from each lot of JANTXV, MIL-S-19500 qualified semiconductors intended for use in Mission Class A/B applications.

TABLE I. SCREENING REQUIREMENTS

TESTS	MIL-STD-750, METHOD	REQUIREMENTS
Serialization	---	
Particle impact noise detection (PIND) <u>1/</u>	2052	test condition A and paragraph 4.6.4.2 of MIL-S-19500
Interim electrical parameters <u>2/</u>	---	per detail specification
High temperature reverse bias (HTRB)		operate for 48 hrs at $T_A = +150^{\circ}\text{C}$
Transistors (bipolar)	1039	test condition A (80% of maximum rated V_{CE})
Transistors (FETs, power MOSFETs)	1042	test condition B (80% of maximum rated V_{GS})
Diodes (except zener)	1038	test condition A (80% of maximum rated V_R)
Diodes, zener <u>3/</u>	1038	test condition A (80% of nominal V_Z)
Interim electrical and delta parameters <u>2/</u>	---	per detail specification, PDA applies
Power burn-in <u>4/</u>		Operating conditions specified by MIL-S-19500 detailed specification
Transistors	1039	80 hours
Diodes	1038	144 hours
Thyristors	1040	144 hours
Power MOSFETs	1042	240 hours, test condition C
Final electrical and delta parameters	---	Group A-2 parameters as specified in Table I of MIL-S-19500 detail specification. Read and Record, PDA applies
Radiography	2076	
Hermetic seal <u>5/</u>	1071	Condition A,C,D,E or F, maximum leak rate of 5×10^{-8} atm cc/s, except 5×10^{-7} atm cc/s for cavities > 0.3 cc.
Fine <u>6/</u>		
Gross		
Visual examination	2071	

- Notes:
- 1/ Applicable only for devices with internal cavities > 0.0002 cc.
 - 2/ The delta parameters shall be read and recorded.
 - 3/ Omit test of devices with $V_Z < 10\text{V}$.
 - 4/ Reverse blocking test shall replace power burn-in for power rectifiers rated $> 10\text{A}$ rating at $T_c > 100^{\circ}\text{C}$ and for all thyristors.

- 5/ Omit test for painted glass diodes.
 6/ Omit test for metallurgically bonded, double slug diodes.

30.2 Quality Conformance Inspection (QCI) Requirements. The tests of Table II. are to be performed on a sample of the devices (as recommended in the table) from each lot of JANTXV, MIL-S-19500 qualified semiconductors intended for use in Mission Class A/B applications.

TABLE II. QUALITY CONFORMANCE INSPECTION REQUIREMENTS

TEST	MIL-STD-750, METHOD	REQUIREMENTS 4/
Destructive physical analysis 1/ 2/	---	Per requirements of JPL document ZPP-2078-GEN
Group B tests		LTPD = 5
Steady-state operating life 3/	1027	1000 hours per power burn-in conditions of MIL-S-19500 detail specification
Electrical measurements		Group A-2 parameters as specified in TABLE I of MIL-S-19500 detail specification. Read and record

- Notes:
- 1/ Metallurgically bonded, double slug diodes should be cross-sectioned so that the die to slug interface can be examined only.
- 2/ Sample size shall equal two (2) devices or 1% of the test lot, whichever is greater, plus one additional sample for cavity packages, to a maximum of five (5) total devices.
- 3/ Perform hermetic seal test following operating life test, when applicable.

APPENDIX D - UPGRADE SCREENING AND QUALITY CONFORMANCE INSPECTION
FOR CLASS B MIL-M-38510 MICROCIRCUITS

10. SCOPE

This appendix defines the requirements for upgrade screening test and quality conformance inspection (QCI) requirements for MIL-M-38510, Class B microcircuits for use in Mission Class A/B applications. These requirements applicable for microcircuits qualified to MIL-M-38510, Class B level only. For devices not qualified to MIL-M-38510, Class B, refer to Appendices A and B for screening and quality conformance inspection requirements.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. DETAIL REQUIREMENTS

30.1 Screening requirements. The tests of Table I. are to be performed on 100% of the devices from each lot of Class B, MIL-M-38510 qualified microcircuits intended for use in Mission Class A/B applications.

TABLE I. SCREENING REQUIREMENTS

TESTS	MIL-STD-883, METHOD	REQUIREMENTS <u>1/</u>
Serialization	---	
Particle impact noise detection <u>2/</u>	2020	test condition A
Radiographic inspection <u>2/</u>	2012	two (2) orthogonal views
Initial (pre-burn-in) electrical parameters	5005	<u>3/</u> read and record subgroups 1, 2, 3, 9
Static burn-in	1015	96 +8/-0 hours at +125 +0/-3°C, V _o = high
Interim (post burn-in) electrical parameters and deltas	5005	<u>3/</u> read and record subgroup 1
Additional static burn-in, if applicable	1015	96 +8/-0 hours at +125 +0/-3°C,
Interim (post burn-in) electrical parameters and deltas	5005	<u>3/</u> read and record subgroup 1
Dynamic burn-in	1005	240 +8/-0 hours at +125 +0/-3°C (320 +8/-0 for hybrids). Test condition F shall not apply.
Final electrical parameters and deltas	5005	<u>3/</u> Read and record subgroups 1, 2, 3, 9, 10, 11
Seal, fine and gross	1014	
External visual	2009	10x magnification

- Notes:
- 1/ Except as noted the requirements shall be per Class S of the applicable MIL-M-38510 detail specification.
 - 2/ May be performed anytime after serialization and prior to final electrical measurement.
 - 3/ PDA of 5% on electricals and deltas; 3% on functionals or one device, whichever is greater, for all burn-in tests combined.

30.2 Quality Conformance Inspection (QCI) Requirements. The tests of Table II. are to be performed on a sample of the devices (as recommended in the table) from each lot of Class B, MIL-M-38510 qualified microcircuits intended for use in Mission Class A/B applications.

TABLE II. QUALITY CONFORMANCE INSPECTION REQUIREMENTS

TEST	MIL-STD-883 METHOD	REQUIREMENT
Destructive physical analysis (DPA)	---	2 devices or 1% of lot, whichever is greater, plus 1 additional sample for cavity packages, to a max. of 5 parts, per JPL document ZPP-2078-GEN.
Class S, Group B	5005	
Subgroup 5		LTPD = 5 <u>1/</u>
Electrical parameters	---	per detail specification, Class S <u>4/</u> <u>5/</u>
Life <u>2/</u>	1005	Test condition D or E
Electrical parameters and delta criteria <u>3/</u>	---	per detail specification, Class S <u>4/</u>
Seal, fine and gross	1014	---

- Notes:
- 1/ Either 45 pieces for 1000 hours or 22 pieces for 2000 hours.
 - 2/ At +125°C, use screening dynamic burn-in circuit.
 - 3/ Delta computation at +25°C for information only.
 - 4/ Read and record subgroups 1, 2, 3, 9, 10, 11 as applicable.
 - 5/ Skip this step if subgroup 5 test is started soon after completion of screening.

APPENDIX E - BURN-IN TIME-TEMPERATURE REGRESSION REQUIREMENTS

10 . SCOPE

This appendix contains the required burn-in and life test duration for microcircuits and hybrid electronic parts with maximum operating temperatures equal to or lower than 125°C.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. BURN-IN REQUIREMENTS

This table is derived from the requirements of MIL-STD-883, method 1015. This test method should be referenced when using this table.

Note: Burn-in at +125°C is required unless authorization from JPL is obtained prior to initiation of testing.

Table I. Burn-in time/temperature regression

Minimum temperature T_A (°C)	Minimum time (hours) <u>4/</u>			Test Condition (MIL-STD-883) <u>2/</u>	Minimum reburn-in (hours) <u>3/</u>
	Mission Class A/B	Mission Class C	Mission Class A/B Hybrids		
100	530	350	700	A - E	24
105	450	300	600	A - E	24
110	380	260	520	A - E	24
115	330	220	440	A - E	24
120	280	190	380	A - E	24
125	240	160	320	A - E	24
$T_A > 125$ <u>1/</u>	N/A	N/A	N/A	---	---

Notes: 1/ Ambient temperatures above +125°C are not allowed.
2/ The only allowed conditions are as stated above.
3/ Reburn-in required if post-test measurements can not be taken within 96 hours of the completion of burn-in, per MIL-STD-202, method 1015, paragraph 3.2
4/ Assumed activation energy $E_A = 0.40$, and junction temperature $T_J \leq +175^\circ\text{C}$. Maximum allowable junction temperature will vary by device, technology, and package. Manufacturer's guidelines should be followed.

30.2 LIFE TEST REQUIREMENTS

This table is derived from the requirements for MIL-STD-883, method 1005.
This test method should be referenced when using this table.

Note: Life test at +125°C is required unless authorization from JPL is obtained prior to initiation of testing.

Table II. Steady-state Life time/temperature regression

Minimum Temperature T_A (°C)	Minimum time (hours) <u>3/</u>			Test Condition <u>2/</u>
	Mission Class A/B	Mission Class C	Mission Class A/B Hybrids	
100	2190	2190	2190	A - E
105	1860	1860	1860	A - E
110	1580	1580	1580	A - E
115	1350	1350	1350	A - E
120	1160	1160	1160	A - E
125	1000	1000	1000	A - E
$T_A > 125$ <u>1/</u>	N/A	N/A	N/A	A - E

Notes: 1/ Ambient temperatures above +125°C are not allowed.
2/ The only allowed conditions are as stated above.
3/ Assumed activation energy $E_A = 0.40$, and junction temperature T_J equals ambient temperature T_A . Maximum allowable junction temperature will vary by device, technology, and package. Manufacturer's guidelines should be followed.

APPENDIX F - IN-PROCESS INSPECTION REQUIREMENTS

10 . SCOPE

This appendix contains requirements for the in-process inspection of electronic devices during fabrication. For Mission Class A applications, in-process inspection is required as stated below; for Mission Class B applications in-process inspection to a military Class B equivalent level is required. In-process inspection is not required of devices for Mission Class C applications.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. IN-PROCESS TESTS

30.1 ASICs. The in-process inspection for ASIC devices is per the Class V requirements of MIL-I-38535 or equivalent.

30.2 Capacitors. The in-process inspection for capacitors is per the requirements for the highest quality level of the applicable military specification or equivalent.

30.3 Crystals. In-process inspection is not required for crystals.

30.4 Discrete Semiconductors. In-process inspection for semiconductor devices is per the JANS requirements of MIL-S-19500 or equivalent.

30.5 Filters. The in-process inspection for filters is per the Class S requirements of MIL-F-28861 or equivalent.

30.6 Fuses. In-process inspection is not required for fuses.

30.7 Hybrids. In-process inspection is per the requirements of JPL specification CS515580 or equivalent.

30.8 Inductors/Coils. The in-process inspection for inductors are per paragraph 5.5.8 of MIL-STD-981 or equivalent. In-process inspection shall include prepot visual inspection as defined in paragraph 5.5.12 of MIL-STD-981 or equivalent. For custom built inductors, electrical measurements shall be made after each winding is applied and immediately prior and subsequent to the potting process. The electrical measurements can be part of the prepot inspection as defined above. All measurements are read and record.

30.9 Microcircuits. In-process inspection for microcircuits is per the Class S requirements of MIL-M-38510 or equivalent.

30.10 Relays. In-process inspection for relays $0 < I < 5A$ is per JPL specification CS515579, and for relays $I \geq 5A$ the inspection is per JPL specification CS515903 or equivalent.

- 30.11 Resistive Heaters. In-process inspection is not required for resistive heaters.
- 30.12 Resistors. In-process inspection is not required for resistors.
- 30.13 Resistor Networks. In-process inspection is not required for resistor networks.
- 30.14 Switches. In-process inspection is not required for switches.
- 30.15 Thermal Sensors. In-process inspection is not required for thermal sensors.
- 30.16 Thermistors. In-process inspection is not required for thermistors.
- 30.17 Transformers. The in-process inspection for transformers is per paragraph 5.5.8 of MIL-STD-981 or equivalent. In-process inspection shall include prepot visual inspection as defined in paragraph 5.5.12 of MIL-STD-981 or equivalent. For custom-built transformers, electrical measurements shall be made after each winding is applied and immediately prior and subsequent to the potting process. The electrical measurements can be part of the prepot inspection as defined above. All measurements are read and record.